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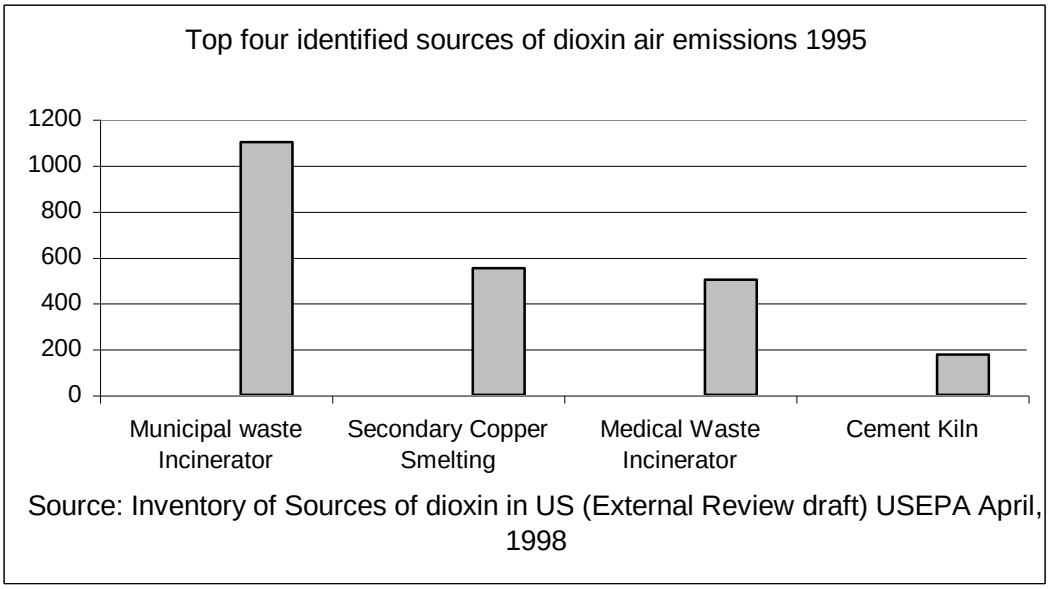
DIOXINS-MOLECULES OF DEATH

What are dioxins?

Dioxins are a group of dangerous toxic chemicals known as Persistent Organic Pollutants (POPs). Once POPs enter the environment or body, they are there to stay. They have the ability to accumulate in fat in our bodies. Their half-life in the body is, on an average seven years[1]. They bio-accumulate in the food chain and the higher one goes, the higher is the concentration of dioxins.
They are seventy-five different forms of dioxin, the most common and most toxin being 2,3,7,8-tetracholorodibenzo-p-dioxin, or TCDD.The toxicity of other dioxins and chemicals like polychlorinated biphenyls (PCBs) that act like dioxin are measured in relation to TCDD.

Where do they come from?

Dioxins are mainly by-products of industrial processes but can also result from natural processes, such as volcanic eruption and forest fires. These compounds are however unwanted and unintentional by-products of thermal process involving chlorine-containing organic substances. They are not deliberately manufactured. Industrial processes that involve chlorine (such as paper bleaching and pesticide and plastics manufacturing), or processes that burn chlorine with organic matter (such as waste incineration)" form toxins.
In terms of dioxin release into the environment, solid, municipal and medical waste incinerators have been the worst culprits.



Source: Inventory of Sources of dioxin in US (External Review draft) USEPA April, 1998

Processes such as hazardous waste incineration, metal smelting, vehicles running on leaded gasoline, paper and pulp industry etc also produce toxins.

"Good Incineration" also produces dioxin

Medical waste incinerators remain one of the largest dioxin producers. In fact in 1995, they were the number one dioxins producers in the US. Subsequently, over 4000 of the closed down there as making this source number three in 1998. Due to the high amount of PVC (Poly Vinyl Chloride) used in the medical sector, which is a very rich source of chlorine, metals present in the waste act as a catalyst to dioxin formation.

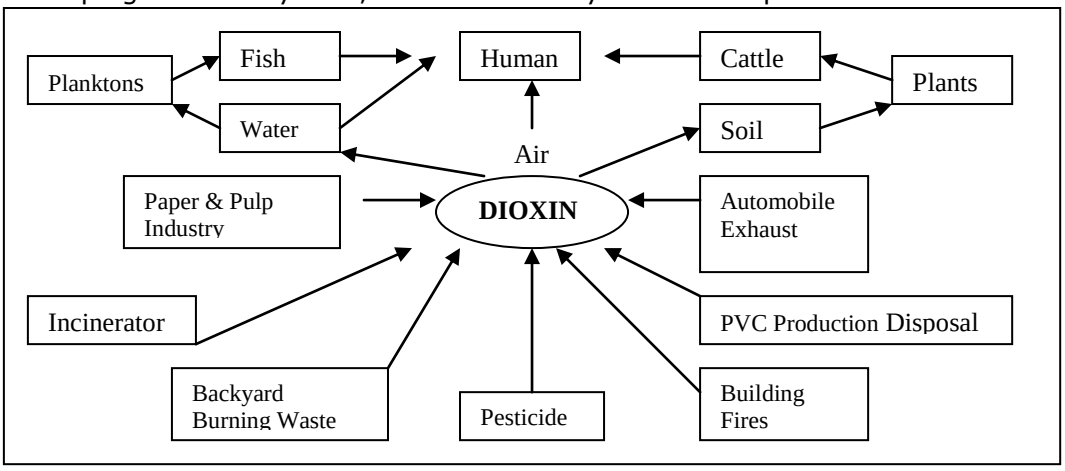
Initially the industry denied charges of dioxin formation on the grounds that as long as high temperatures are maintained in the incinerator, dioxins would not be produced. But later, it was proved that dioxin could be reformed after the flue gases left the combustion chamber. It is now well established that if flue gases are passed through pollution control equipment working in the temperature range of 200-400^{o}C, there is a one hundred fold increase in dioxin and furan formation . Moreover if the pollution control equipment captures the pollutants in flue gases, the fly ash becomes heavily contaminated.

Minimizing dioxin formation would require an immediate quenching of flue gases, once they leave the combustion chamber which work against energy recovery. As continuous monitoring of dioxin emissions are difficult, it is always a big risk to run it. [2]

What are the effects of dioxins on human health?

Dioxin is one of the most toxic chemicals known draft report released for public comment in September 1994 by the US Environmental Protection (USEPA) Agency clearly describes dioxin as a serious health threat. According to the USEPA report not only does there appear to be no "safe" level of exposure to dioxin, but levels of and dioxin- like chemicals have been found in the general US population that are "at or near levels associated with adverse health effects".

Short-term exposure of humans to high levels of dioxins may result in skin lesions, such as chloracne and patchy darkening of skin, and altered liver function. Long-term exposure is linked to impairment of the immune system, the developing nervous system, the endocrine system and reproductive functions.[3]



ANTHROPOGENIC SOURCES OF DIOXINS, Source: Down to Earth, August 31,2001

Dioxin politics

Despite knowing their carcinogenic nature, there is no monitoring of these chemicals in most countries. Even at places where they are monitored, dioxin politics are extremely intense.

In the US, awareness about dioxin has generated much public debate.

In 1991,the paper industry and the Chlorine Council (a trade group) pressured EPA to relax the few dioxin standards that the USEPA had set at the time. In response, EPA has spent the next four years re-examining the toxicity of dioxin, in preparation for deciding what to do about it .The EPA released a draft of its

nine volume 'dioxin reassessment'. In this report the EPA found even stronger links between exposure to dioxin and adverse impacts on human health; a fact that the industry groups never wanted the public to know. The industry intensified its aggressive stalling efforts and bottled up the final report released in July 2001.The release of this final EPA report would have meant expensive consequences to the US chemical, beef and poultry industries. Besides, it also entailed far-reaching implications for public health policy of the US government.

USEPA'S Findings

The USEPA claims that the average U.S citizen has no particular exposure to dioxin besides what is routinely eaten in food-mainly in red meat, fish and dairy products. This routine dietary exposure has produced an average body burden that is estimated to be 13 nanograms of dioxin per kilogram of body weight (ng/kg).(a nanogram is a billionth of a gram. EPA estimates that that 5% of Americans –some 12.5 million people have body burdens twice the average.[4)]

The EPA also recommends against establishing a "reference dose" (RfD) for dioxin. RfDs are used to set limits below which there are not likely to be a risk of non-cancer health effects. But the EPA says: "Any RfD that the Agency would recommend...is likely to be 2-3 orders of magnitude (100-1000) below current background intakes and body burdens...discussion of an RfD for an incremental exposure when the RfD has already been exceeded by average background exposures is meaningless." (p. 91) In other words there is no margin of safety from current background exposure to dioxin to people living in the US.[5]

DAMNING FACTS

- Cancer risk from dioxins among people eating large amounts of fatty meats and dairy products.
- Dioxin exposure is linked to variety of health problems, including diabetes, developmental problems and irregularities in the immune system.
- Children's intake of dioxins is greater than those of adults.
- Dioxins are 10 times more dangerous than thought before.
- 11% of all cancer deaths are due to dioxins
- Incineration is the main source of dioxins
- Burning trash in back yards is one of the largest unaddressed dioxin sources.
- Dioxin exposure from breast feeding is 100 times higher than the adult daily intake or about 10% of the lifetime intake

Economic aspect of dioxin analysis.

The laboratory and regulatory infrastructures required to monitor dioxin levels in incinerator releases-stack gases, fly ash, bottom ash or slag, and other residues (e.g., effluent and sludge from wet scrubbers, quenching water, etc) and to ensure compliance with requisite legal standards are both costly and complex. For example WHO has certified fewer than 50 laboratories in the world for the analysis of dioxins in human tissue, and the cost of such an analysis ranges from US$1,000 to US$3,000 per sample.[6]

The cost of establishing a laboratory for dioxin analysis is estimated at US$ 1.5-2 million.[7]Even in the wealthiest countries, such costs are barriers to adequate monitoring of incinerator releases, as illustrated by the admitted paucity and uncertainty of relevant data presented in the European Union's dioxin inventories.[7, 8]

History of dioxins in India.

During 1997 when the Supreme Court passed a ruling for the installation of incinerators in all hospitals with bed strength of 50,to the above, Srishti

intervened and the Hon'ble Court directed the Central Pollution Control Board (CPCB) to (a) allow for non-dioxin creating technologies such as waste autoclaves and microwaves and (b) make standards for such technologies. In this survey carried out during May 1997**,**thirty-two major hospitals in Delhi were inspected; thirteen of these had incinerators, while four were in the process of acquiring new incinerators. Most of the incinerators were not complying with the temperature norms. Six of them were old and operated very inefficiently. This survey and others carried out by Srishti highlighted the fact that even expensive incineration did not work well in the field.

In most of the installations it was found that either the burners were out of order or were not being ignited to save oil. The chamber temperature were in the range of **190-400 degree C which the temperature dioxins and furans are optimizing.**

Subsequently, the Srishti survey revealed that 82%of the incinerators were burning mixed waste and 80% of the incinerators were not maintaining the temperatures specified in the rules.

Thus though most of the hospitals had incinerators, their operation and maintenance was poor. The burner of secondary chamber, in most of the incinerators did not work thus causing emission of harmful pollutants.

The hospitals were also found to be incinerating mixed plastic wastes.

Later the CPCB also carried out stack emission monitoring in the seven hospitals of Delhi. **Results show that the particulate matter is more than five to fifty times of the permissible limit** in the incinerators installed in the hospitals.

S.No	**Particulate Matter (mg/Nm 3)**		**Hydrogen Chloride (mg/Nm 3)**	
	Permissible Limit	Actual Values	Permissible limits	Actual values
1.	150	951.1	50	67
2.	150	1873.9	50	65.3
3.	150	816.7	50	122.3
4.	150	1219.2	50	49.4
5.	150	8583.6	50	53.0
6.	150	3312.5	50	195.7
7.	150	1546.1	50	178.2

Though it is possible to reduce the amount of particulate matter released by ensuring better combustion and installing various pollution control devices, it cannot be eliminated.

These results are a clear indicator of the inoperability of incineration in hospital settings.

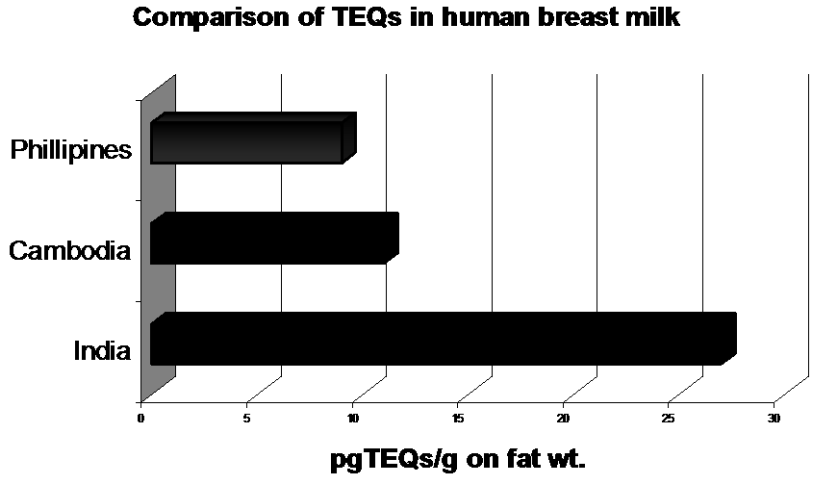
Dioxin levels alarmingly high in India

Indians are yet to realize the gravity of dioxin contamination and its related health effects. The government has not conducted any study to find out the level of dioxin exposure in the population. Dioxins are not monitored in the country. Two recent studies, based on human samples, have been found to be in very high amounts in samples of Indian breast milk, meat and dairy products. Until now ignored as a western problem, this scary trend should make our environmental managers and industry sit up.

In the first study, dioxins were detected in human breast milk samples collected from Perungudi, Chennai in India on August 2000,which have dumping sites of municipal wastes in the suburbs of urban area. Dioxin levels were found to be

even higher when compared with those in the general public of developed countries, such as Japanese, Americans, and Canadians. This indicates that the significant pollution sources of dioxin-related compounds are present in the dumping sites in India, probably due to secondary formation caused by burning of municipal wastes.[10]
In the second recent study, concentrations of dioxins were measured in tissues of humans, fishes, chickens, lambs, goats' predatory birds and Ganges River dolphins, collected from various locations in India. Dioxins were found in most of the samples analyzed, with the liver of the spotted owlet containing the highest concentration of 3,300-pg/g fat weight while in the human fat tissues they existed in concentrations ranging from 170 to 1300 pg/g fat weight. As compared to even the conservative WHO limits of 1-4 pico grams per kg of body weight, the study translated to alarmingly high contamination levels. This is the first report of its kind detecting dioxins in human tissues, fishes, and meat and wildlife samples collected from India**.**[11]

Why are these studies so significant? Firstly, they are the first ones to be carried out in India, and among a few in developing countries.
Secondly till date India has been refusing to acknowledge that dioxins are a problem .In the recently concluded UNEP Convention on Persistent Organic Pollutants, India was silent on the dioxin issue treating it as 'not our problem'.
In India we are likely to face a crisis soon. While the developed world are has over the years managed to reduce dioxin emissions through expensive measures and strict regulation, we do not even have the facilities to test them. Simultaneously there is transfer of dirty technologies in India. Waste incineration, the highest source of dioxin release abroad, is not only being propagated, but also subsidized in India through the programs of the Ministry of Non Conventional Energy Sources.



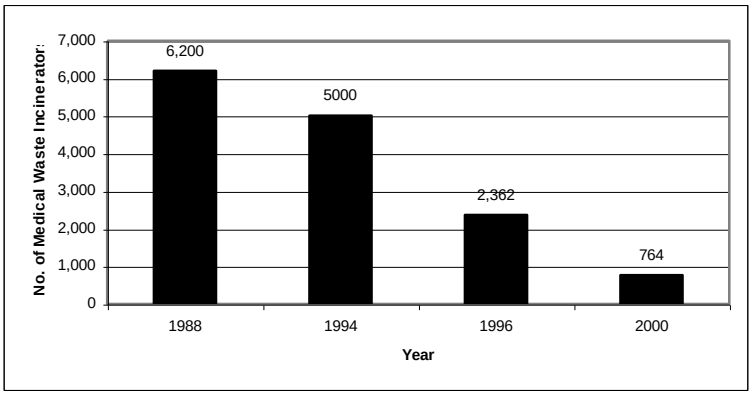
Reference data recalculated with TEFs by Van den Berg Et al(1998)

Dioxin related compounds (PCDDs, PCDFs, and coplanar PCBs) were detected in all samples of human breast milk analyzed, indicating that the residents around dumping sites of municipal wastes in India, Cambodia and Philippines have been exposed to these contaminants. The TEQs of dioxin related compounds in human breast milk were in the order of India>Cambodia>Philippines.

Global shift of incinerators towards third world countries

The US and other OECD countries have been shutting down medical waste incinerators and reducing the total amounts of waste sent to dedicated MWIs. This has helped them substantially decrease dioxin emissions. However, the trends and pressures in developing countries and countries in transition appear to be moving in the opposite direction.

Decline of Medical Waste Incinerators in United States



This chart shows the decline in medical waste incinerators in use in the United States. The first two figures are based on earlier estimates; the last two figures are based on surveys. ***The total number of incinerators has declined even further since 2000.***

It is also significant to note that since June 1996, only four new medical waste incinerators have been constructed in the United States (as against EPA's projection of 700) and one of those four has since closed down.

A study in 1996 conducted by the *Environmental Working Group* compiled from EPA data (EPA 1996) showed that one half of all the medical waste incinerators in USA listed by EPA ***had no pollution control devices.*** US EPA's increasingly stringent pollution control standards and their enforcement proved to be the major cause behind rapid decline in the number of incinerators.

If the authorities become stricter in India, similar trends can be observed as the cost of pollution control equipments are very high and few of the hospitals would be able to afford them. The pollution control devices prevalent in India for medical waste incinerators only reduce the pollutants like SPM (suspended particulate matter), nitrogen oxide and sulphur oxide from the smoke. The most recent USEPA guidelines will ensure that 70 % to 80% of all small and medium medical waste incinerators fall in line because of the stringent pollution control norms being enforced. The other incinerators will have to invest hundreds of millions in pollution control technology, which will have to be upgraded whenever the USEPA increases the pollution norms. If Indian incinerator manufacturers state that their incinerators follow the USEPA norms, the incinerators would cost crores of rupees and not just a few lakhs, which is the price of the state-of-the-art incinerators today.

Dying from Dioxin

Environmentalists agree that dioxins are being produced all over the country but due to lack of any unscientific studies, no one knows the magnitude of the problem. Neither the existence of dioxins nor the sources of dioxins are currently officially acknowledged by the government agencies. A major source of dioxins in the country is poly vinyl chloride (PVC) both during its production and disposal. Burning of unsegregated waste containing PVC is a common practice in India.

What is alarming is the fact that plastic percentage is increasing in our waste and PVC is extensively used in our country.
The Central Pollution Control Board estimates that the per capita consumption of plastic has gone up from1.7 kg in 1997 to 4 kg in 2000.Other estimates point out that in the next two years PVC capacity in India is expected to increase by around 1,30,000 tonnes. At present, Indian plastic industry produces more than 70,000 tonnes of PVC a month. At current rates, PVC supply will fall short of its demand, which is expected to rise at a compound annual growth rate (CGAR) of 13%. **The shortage will mean importing more PVC, generating more PVC waste, burning more PVC, and finally producing more dioxins.**

Dealing with dioxins

Prevention is key to deal with the problem of dioxin. For India, prevention becomes all the more important because we cannot afford the costly dioxin control mechanisms and the unsustainable industrialization it comes from. It is argued that large amount of dioxins can be prevented from being released in India if PVC products are labeled. The lifecycle of PVC plastic is the cause of dioxin formation than any other single material. Sources in which PVC is a major chlorine donor account for a significant proportion of the identified dioxin emissions in the EPA's inventory. PVC is a significant, and sometimes predominant, chlorine donor in most of the major dioxin sources, including municipal and medical waste incineration, accidental fires and open burning. The health risk posed by dioxins calls for immediate action. As a major cause of dioxin pollution and numerous other environmental impacts, PVC must be a priority in any dioxin prevention program. Therefore policies should aim at rapid phase out of all short-life PVC uses like packaging, toys etc.
Another option is to introduce the concept of extended producer responsibility (EPR) whereby the manufacturer and distributor is made responsible for the packaging it creates, thus avoiding littering of chlorinated packaging material. Various type of eco-taxes could be proposed to change consumer behaviour and move them away from hazardous products like PVC.[12]

Dioxins are the most intricate chemicals known to us and much more research will be needed to identify the various sources of dioxin. But already many countries are phasing out uses of chlorine and PVC.Germany, for instance has banned the use of PVC in building construction. Manila and Philippines has already banned all incineration.

Eliminating the dirty dozen
On May 23, 2001, governments of the world adopted a global, legally binding treaty called *the Stockholm Convention on POPs*. In its first Article, the Convention calls attention to the Precautionary Approach. It declares that the Convention's objective is *"to protect human health and the environment from POPs."* ("POPs" is short for "Persistent Organic Pollutants," a class of toxic chemical pollutants that are widely present in the environment and that are harmful to human health and to wildlife. POPs appear as toxic contaminants in human food in all regions of the world; POPs harm workers who use or produce them; and POPs also cause harm in communities nearby where they are used, produced and stored.)
Persistent organic pollutants (POPs) are established toxins and are being outlawed or restricted throughout the world. Stockholm convention on POPs is the treaty, which aims at elimination of these toxins. The treaty was finalized in Johannesburg in December 2000 after a marathon discussion lasting two and a half years.

On May 23,2001,ninety-one countries and the European Commission signed the treaty. India made the international commitment in early April this year. According to the treaty, international action will be taken to eliminate 12 POPs, which include dioxin and furans. With India signing the Stockholm Convention it shall have to take measures to reduce the releases of Dioxins and Furans with the goal of their continuing minimization and where feasible ultimate elimination. India will have to develop an action plan (and subsequently implement and evaluate) current and projected releases including the development and maintenance of source inventories and release estimates.

Dioxins from combustion are virtually everywhere in the world. It is a global threat, and it requires a global commitment. There is an urgent need to ensure that countries can get the tools and build the base for reducing or eliminating releases of persistent organic pollutants. The EPA believes that people who eat rich diet containing dioxin may face a 1-in-100 risk of developing some form of cancer, diabetes or immune system disorders. Incineration technologies like gasification and pyrolysis to generate electricity, which in the process emit this very toxin. This state of affairs speaks volumes about the way; the country is dealing dioxins. The issue provides a great opportunity to strengthen a new strategy. That has to be based on the formulation and implementation of an environmental programme of action in which one of the central points is international cooperation and implementation at the regional level. Dealing with the dioxins and dioxins like toxins require greater capacity for our institutions to address these environmental priorities locally with consistent coordination among government agencies, non-governmental organizations and international institutions.

(*Compiled and written by Ratna Singh with inputs from the medical waste team*)

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